

measured is attached to the stage of the microscope, the traversing slide of which is provided with a vernier scale, while a vernier cross-hair in the eye-piece forms the index of the instrument. When the microscope has been adjusted for clear focus, the screw is traversed across the field until the cross-hair intersects the thread of the screw at the desired point. The traversing screw of the slide is then turned until the corresponding point of the next thread is intersected by the cross-hair, and the reading of the vernier on the scale gives the measurement of the pitch with great accuracy.

The Committee decided that gauges for ordinary workshop use would be best tested, as regards pitch and form of thread, by a template or "comb," the accuracy of which would be verified by the photographic method. External dimensions could be obtained by micrometer gauge, and the internal diameter, or core, by a gauge suggested by Mr. A. Stroh, a member of the Committee, the details of which have yet to be worked out. The Committee failed to discover any very trustworthy method of testing a female standard gauge. Naturally a mathematically accurate male gauge cannot be screwed into a mathematically accurate female gauge of like dimensions, but the variation should not exceed a "good fit." A table prepared by Prof. Le Neve Foster, dealing with this subject, was added as an appendix. The details given refer to works managers' gauges. Those used by the workman or foreman need not possess the mathematical accuracy of the standard gauges. For full details of this useful report, we must refer our readers to the published *Proceedings* of the Association, where it will be found printed together with the illustrations necessary for its full comprehension.

A long paper, by Mr. W. H. Preece, on "The Tests of Glow-Lamps," followed. It comprised the results of a very large number of tests, the details being given in diagrams handed round at the meeting. It would be impossible here to give even a summary of the results of tests, for the lamps tried were supplied by a number of makers, and varied according to the numerous conditions of trial. Some of the cheaper lamps gave results not at all in accordance with what would be expected from them if the statements of the makers were to be taken as guides. The experiments tended to prove that in continuous lighting for 1000 hours the candle-power fell about 30 per cent., and the watts per candle-power rose about 28 per cent. Lamps for installation work of about $3\frac{1}{2}$ watts per candle-power, burning from seven to nine hours per day, behave, as regards life and efficiency, about the same as when giving continuous illumination; but high efficiency lamps deteriorate more quickly. Good 100 to 105 volt 16-candle-power lamps, taking $3\frac{1}{2}$ volts per candle, should stand a gradual increase of pressure of direct current up to 225 or 280 volts in $3\frac{1}{2}$ minutes before the filament breaks. When the pressure is regularly raised in $2\frac{1}{2}$ minutes to 170 volts, and afterwards re-tested at ordinary voltage, the candle-power should not be less than 14.4, nor higher than 17.6, while the watts per candle should not exceed 4. The author also suggested in his paper a quick and ready way of satisfactorily judging the quality of lamps. To obtain this end the voltage of several lamps was gradually run up for each lamp singly at a uniform rate until the filaments broke. At the moment of rupture the voltage, current, and time of running up were noted. Before increasing the normal voltage the current was measured and the resistance calculated. The average breaking voltage of the filaments was found to be 230, and the time of running up was $3\frac{1}{2}$ to $4\frac{1}{2}$ minutes. Mr. Preece also gave a standard specification for glow-lamps which he had drawn up for use in the Post Office.

Prof. Ayrton, in the discussion on the paper, said that it was to be expected, as noticed by the author, that lamps which gave at first less than their nominal candle-power would last longer, as they were worked at a lower pressure. He pointed out that certain figures given by the author as to the cost of illumination by glow-lamps showed electricity to be dearer than gas burnt in an Argand burner, and very largely in excess of gas burnt by the Welsbach system. It had been noted that the illuminating power had gone up in certain glow-lamps, though the voltage remained constant. That was an interesting point, and one difficult to account for. It had been thought that the improvement was due to improved vacuum, but this was hardly to be believed, and he suggested it might arise from improvement of the filament during use. Prof. Fleming referred to the unsatisfactory nature of the standard candle, and also to the importance of personal error in photometric investigation. Mr. Swan approved of the short test suggested by the author, and pointed out that

the length of life of a lamp depended upon constancy of pressure, a thing often much to be desired in central stations. Mr. Preece, in replying, said that though gas might be cheaper per hour than electricity, yet the ease with which the latter was turned on and off led to less light being wasted, and therefore an equality of cost was produced. If, however, local authorities would use electricity for tram propulsion, the cost of electric light per hour would be brought greatly below that of gas, in consequence of equalisation of the load factor.

A paper by Mr. S. B. Cotterell, on the "Liverpool Overhead Railway," was next read, in which the author described the engineering and other details of this construction. Mr. E. W. Anderson also read a paper on "Electric Cranes," the author expressing opinions favourable to the application of electric power for lifting heavy weights. Papers on "Hysteresis," by Prof. Fleming, and on "Street Lighting," by Mr. Walker, were also read.

The Section had a long sitting on the Tuesday of the meeting, but some of the papers were not of great importance. The first taken was by Captain Jaques, of New York, and was on "Armour and Ordnance." It was devoted largely to showing the great superiority of the United States over the rest of the world in the field. A spherical balanced valve was described by its inventor, Mr. J. Casey. It is an engineer's fitting involving an application of known principle. Prof. Hele-Shaw next gave an interesting description of certain instructional apparatus used in the Walker Engineering Laboratory, including Froude's dynamometer break, the speaker giving an excellent popular description of this ingenious appliance. A good discussion on the subject of technical education followed, in which, among others, Profs. Perry, Beare, Schröter (of Munich), Ritter (of Zürich), Merrivale, and Hele-Shaw took part. The opinion was expressed that the course of instruction proposed for the establishments known as Polytechnics, which have been so plentifully started in this country of late, is too ambitious, and the apparatus so complicated that evening students have not either time or ability to take advantage of it. Papers on "Colour Printing," by Mr. T. Cond, and on "Expanded Metal," a species of network made by slitting metallic sheets, were also read. The last sitting of the meeting was held on Wednesday, September 23. A paper by Mr. J. Bell described a system of wreck-raising, which the author and others had worked out. Lifting pontoons are employed in the ordinary way, but in place of the rise of tide being used to raise the wreck from the bottom, winches are adopted. The details of construction were illustrated by models. Finally a lecture on "Motor Carriages," by Mr. Sennett, was given. It was of an entirely popular character.

This brought the proceedings in Section G to a close.

ANTHROPOLOGY AT THE BRITISH ASSOCIATION.

AFTER the President's Address (*cf.* NATURE, October 1, p. 527), the remainder of Monday was devoted to papers dealing with Prehistoric Archaeology. Mr. Seton Karr exhibited specimens and photographs of the palaeolithic implements which he had collected in Somaliland; these form an interesting link in the series of finds extending from India to Britain. It is well known that ordinary palaeolithic implements of the river-gravel type are wanting in Ireland; but Mr. W. J. Knowles contends that the older flint implements he has found in the north-east of Ireland belong to this epoch, and that some bear striae which "have been pronounced to be glacial." A discussion arose in the afternoon, in connection with some photographs of dolmens in Brittany exhibited by Prof. Herdman, as to the age of such structures. Prof. Boyd Dawkins maintained that they belonged to the Bronze Age, while Dr. Montelius, Dr. Garson, and others recognise that they are essentially Neolithic.

The proceedings on Friday commenced with speeches by the President, Sir William Turner, Prof. A. Macalister, and Mr. Brabrook, in commemoration of the centenary of the birth of Prof. A. Retzius, who was the originator of some of the modern methods of craniology, and who did a great deal to stimulate anthropological science in Scandinavia. Mr. A. W. Moore and Dr. J. Beddoe read a joint communication on the physical anthropology of the Isle of Man as analysed from the "Description Book of the Royal Manx Fencibles," in which are contained particulars of 1112 Manxmen enrolled between 1803 and 1810. Speaking roughly, there are

three ethnic districts: in the north-west the stature is highest, but dark hair and eyes are least prevalent; dark hair, coupled with grey eyes, is most abundant in the somewhat infertile parishes of Maughold and Lonan; while dark eyes are comparatively frequent in the central parishes where the Scandio-Gaelic stock is probably less pure. The chief paper of the day was an elaborate study of the Trinil femur, by Dr. D. Hepburn. The femora of various savage and civilised races were compared with that of *Pithecanthropus erectus*. The author dealt especially with the popliteal space, and followed the methods adopted by Manouvrier; in fact, this paper was largely an extension of the French investigator's careful study. He noted the absence of symmetry between two femora of the same individual, and exhibited an Australian femur with the same popliteal measurements and index as those of the Trinil femur. The condyles of the Trinil femur are human, and not simian. The author stating that the distinguishing features of the Trinil femur are found singly and in conjunction on human femora, with sufficient frequency to enable them to rank as human characters; and thus its features do not entitle it to the distinction of a separate genus, but it is a true human femur, although of very ancient date. This paper led to a good discussion, in which several speakers took part. Prof. Boyd Dawkins did not regard the Trinil find to be of Pliocene Age. Dr. Garson believed that these specimens belonged to a new genus and species of the Hominida. Sir John Evans reserved his judgment; this he summed up in his felicitous manner in the following rhyme, which was not, however, uttered in public:—

About three things pray let us have the truth—
The skull, the thigh bone, and the Trinil tooth.
The thigh is human, does the skull belong?
Is the tooth human, or is Dubois wrong?
But, after all, where were the relics found—
Was it in ancient or in modern ground?

Dr. Garson exhibited a lantern slide of an outline figure which embodied the mean proportions of the head, body, and limbs of the members of the British Association who have been measured at the various meetings. In the afternoon Mr. F. T. Elworthy gave a fully illustrated lantern demonstration of the survivals in modern South Italian charms from very ancient Pagan times.

On Saturday morning Mr. Brabrook presented the Report of the Ethnographical Survey of Great Britain and Ireland, which showed that the survey is steadily progressing. There were several appendices to this report, the two most important being Dr. W. Gregor's, on Galloway folk-lore, and one by Mr. Gomme, on the method of determining the value of folk-lore as ethnological data. This was a solid and novel contribution to the right apprehension of folk-lore, which deserves to be widely read; it consisted mainly of an analysis of fire rites and ceremonies in the British Islands. Among these numerous customs nine are reckoned as constituent elements, two are suggestive of the original culture stage (the use of stone implements), while eight are divergent elements. If lines are drawn on a map connecting the localities where more or fewer of these customs occur, an "ethnological test-figure" is arrived at for each country. These fire customs are held to be of Aryan origin. Mr. Gomme has previously stated reasons for considering water-worship customs to be non-Aryan in origin; to belong, therefore, to the pre-Celtic people of these islands, and the "ethnological test-figure" produced by mapping the occurrence of water customs, differs radically from that connected with fire customs.

Mr. C. H. Read urged the formation of an Ethnological Bureau for this country, analogous but not similar to the famous Bureau of Ethnology in the United States. He recognised that a certain amount of partial or isolated work was being done in India and elsewhere, but what was wanted was a uniform system of inquiry extending all over our possessions, and the collection and collation of the results in a central office. He recommended (1) that the reports should be systematised and on a uniform method, (2) that such work should be held to be part of the duties of the local Government officer, and consequently (3) the officer should obtain credit for such work when well done. In conclusion, he repeated, "a nation having under its Government or protection so many primitive or uncivilised races, as are now within the confines of the British Empire or upon its borders, is bound both by interest and policy to study and to put on record all facts connected with their history, beliefs, and manners and customs, the knowledge of such facts being, in the first place, essential to the maintenance of peaceful and friendly relations, and, in the second, of the highest interest to science." The proposition was warmly supported by Profs. Macalister, Boyd

Dawkins, Haddon, and Sir John Evans. In his paper on "Anthropological opportunities in British New Guinea," Mr. S. H. Ray re-affirmed the danger of delay in investigating the anthropology of British New Guinea, and called attention to the opportunities which exist for successfully carrying it out. If anything is to be done, it should be done soon. Stress is laid upon languages as folk-lore; religious beliefs and practices and legal customs can only be thoroughly studied through the medium of the languages. We want to know the native's reason for his thought and practice, as the European often draws most erroneous conclusions from his own observations. The country is now quiet and safe, and facilities would doubtless be offered by the present enlightened administrator, Sir Wm. MacGregor. Prof. Haddon followed with an earnest appeal for the immediate investigation of the anthropology of all islands and other districts where the indigenous population is being exterminated or largely modified by the advent of the white man.

Monday morning was devoted to a discussion of the origin of the knowledge of copper and iron in Europe. This was led off by Mr. J. L. Myres, who indicated the part played by Cyprus and its relation to the trade routes of South-east Europe. Dr. J. H. Gladstone gave a series of analyses of prehistoric metal implements, which demonstrated a transition for the use of pure copper to the widely-spread bronze; various methods for hardening the copper were employed, such as the sub-oxides of copper and various natural alloys of copper with antimony and arsenic, but when the tin bronze was discovered it quickly superseded all the others. An interesting discussion followed, in which Dr. Munro maintained that there was no proof of a Copper Age in Europe, the copper implements being "starved" bronze, and only manufactured when the supply of tin ran short; but this view did not gain general support. Prof. Ridgeway read a paper on the starting-point of the Iron Age in Europe, in which he pointed out that Hallstatt, in Austria, is the only place in Europe where articles of iron are found gradually replacing those of the same kind made in bronze, and that within a very short distance of the Hallstatt cemetery lies one of the most famous iron mines of antiquity, Noreia. He suggested that the accidental finding of an outcrop of volcanic iron, such as that known in at least one place in Greenland, led to iron smelting; there is no need to suppose that meteoric stones first supplied man with that metal. This theory was adversely criticised by several speakers. Mr. Myres gave an abstract of Sergi's theory of a Mediterranean Race (this subject has already been referred to in our columns). It was a disappointment to many that Prof. Sergi was unable to fulfil his promise to be present and explain his views. Dr. Munro and Prof. Boyd Dawkins detailed at length the results of the recent excavations of the Lake Village of Glastonbury. A model of accurate archaeological research was afforded by Dr. Stolpe, of Stockholm, in his account of the Vendel finds in Sweden. These boat graves ranged from a period of about 600 to 1000 A.D., and various modifications were noted during that period; numerous beautiful drawings and lantern slides of the bronze objects found were exhibited. Mr. R. A. S. Macalister gave an interesting account of a recent exploration he had made of a prehistoric settlement in Co. Kerry, which was illustrated by numerous lantern slides.

A great discussion on the early civilisation of the Mediterranean was opened on Tuesday morning, in a fine fighting speech by Prof. Ridgeway, entitled "Who produced the object called Mykenæan?" The genial Irishman made a brilliant onslaught on many generally recognised views. The credit of this civilisation belonged either to the Achæans or to the Pelasgians. The traditions of the Greeks themselves point to the latter. The age of Mykenæ is that of Bronze, that of Homer's Achæans is distinctly of Iron. Engraved gems are characteristic of Mykenæ, but these were unknown to Homer; but the converse is the case with fibule. The Mykenæans had a peculiar figure of 8 shield, no breastplate, no metal greaves, and they wore their hair in three locks behind; whilst the Achæans had round shields, bronze breastplates and greaves, and wore their hair flowing. There is no need to cut Homer to pieces to fit the Mykenæan Age; this culture is that of the Bronze Period and Pelasgian in origin, and was supplanted by the Iron Age, which was introduced by the Achæans into Greece. Prof. Petrie supported Prof. Ridgeway by adducing the argument of a continuity of artistic pre-eminence from Mykenæan times to the art of Pheidias in Attica, which was a Pelasgian settlement. Dr. Beddoe pointed out that the skull-form of Pericles and other noted Greeks was Pelasgian in

character. Principal Rendall strongly supported the orthodox classical view of Reichel and Leaf, and scoffed at the "Pelagian heresy." Dr. Munro, Sir John Evans, and Mr. Myres continued the discussion; the latter ingeniously showed how a round shield could be twisted into a figure of 8. The President also spoke, and Prof. Ridgeway replied to the criticisms; and so terminated one of the most lively and interesting debates that Section H has ever experienced. Dr. O. Montelius gave a characteristically careful and learned paper on pre-classical chronology in Greece and Italy, in which he distinguished four divisions of the Bronze Age in North and Central Italy, dating from 2100 to 1100 B.C., two Protetruscan Periods, from 1100 to 900 B.C., in Central Italy, and two Central Italian Etruscan Periods from 900 to 700 B.C. The forms of the implements, fibulae, pottery, &c., that characterised these several periods were fully illustrated by lantern slides. He stated that the copper implements were made in the same shapes as those of the old stone implements. Prof. Petrie referred to a recent discovery of his own, in Egypt, of iron tools of such a character that they must have been made by a people long acquainted with iron; they were associated with an Assyrian helmet which can be dated about 670 B.C. This is the oldest known datable iron find. The beginning of the use of copper tools in the Mediterranean area was from 3500 to 3000 B.C. The President read a paper on pillar and tree worship in Mykenæan Greece, as illustrated by signets, on a gold ring from the early Mykenæan Period (about 1500 B.C.) a dual cult of a male and female divinity in their pillar shape is engraved. Other signets show deities as pillars and trees enclosed in small shrines; the cult of the fig-tree and the early sanctity of the dove were referred to; and attention was also drawn to the fact that pillar and tree worship of Mykenæan Greece is seen largely to survive in the rustic cult of classical Greece. Mr. G. Coffey gave a lucid account, illustrated by lantern slides, of the relation of the stone-carvings of the tumuli of New Grange, Dowth and Loughcrew to Scandinavian art. He has lately discovered in Dowth the representation of a boat identical with those inscribed on Swedish rocks; this is the first undoubted example found outside Scandinavia. Other new evidence was brought forward to substantiate his view of a direct borrowing of Norse motives, many of which in their turn had come into Scandinavia from the Mediterranean up the valley of the Danube, and round Hungary. Mr. Kermodé concluded a long and very interesting day's work by describing a magnificent series of rubbings and drawings of Celtic and Scandinavian crosses from the Isle of Man. In a recent number (*cf.* NATURE, October 8, p. 547) we have referred to the appreciation by numerous members of the Association of Mr. Kermodé's endeavours to preserve and record these beautiful and most interesting remains.

Prof. Flinders Petrie brought forward on Wednesday his scheme of an ethnological and archaeological storehouse. Most of the speakers who followed admitted that more room was needed than most existing museums can possibly afford if large collections were to be preserved intact, and it was also recognised that long series of objects were necessary for scientific study. Certain details of his proposed museum were criticised, but Prof. Petrie thought that all these could be met.

An interesting paper on "The Duk-duk and other Customs as Forms of Expression of the Melanesian's Intellectual Life" was read by Graf von Pfeil. During his long stay in the Bismarck Archipelago he came to regard the natives' strong desire for physical and psychical seclusion as an explanation of some of their ceremonial customs. They still hate the white man, and distrust their fellow countrymen. The Duk-duk apparently serves to propitiate evil spirits and to levy blackmail on non-initiates. The Eineth and Marawot ceremonies were described for the first time; the former appears to be related to ancestor worship, and taboos are placed on various foods, actions and words. Little, however, is as yet known about this or the Marawot; the latter consists mainly of a dance on a high platform. The author urged the immediate importance of studying the habits of the Melanesians, owing to the change which is taking place. In the discussion which followed, Mr. Hartland and Prof. Haddon suggested that there was more behind these ceremonies than the author had yet discovered, but he was congratulated on approaching the subject from a psychological point of view. The Count maintained his view that the Melanesian was very largely actuated by mercenary motives.

Mr. F. T. Elworthy announced the very recent discovery of an Ancient British interment in Somersetshire, which led to a

long discussion, the net result of which appeared to be that this was a burial, in a stone cist and with a decorated earthen vessel of the Neolithic type, of a man who, by his skull, undoubtedly belonged to the Bronze Race.

This session was one of the most successful of any meeting of Section H. Most of the papers maintained a high level, and the pre-arranged discussions proved an interesting and instructive feature. Numerous distinguished foreigners had expressed their intention of being present, but, unfortunately, only Drs. O. Montelius and H. Stolpe, and Prof. W. H. Goodyear actually arrived.

FORTHCOMING BOOKS OF SCIENCE.

MESSRS. LONGMANS, GREEN, & CO.'S list includes:—

"Fridtjof Nansen, 1861-1893," by W. C. Brøgger and Nordahl Rolfsen, translated by William Archer, illustrated; "Memories and Ideals," by Sir Benjamin Ward Richardson, F.R.S.; "Life in Ponds and Streams," by W. Furneaux, illustrated; "Contributions to the Science of Mythology," by the Right Hon. Prof. F. Max Müller, two vols.; "Essays," by Dr. George John Romanes, F.R.S., edited by Prof. C. Lloyd Morgan. Contents:—Primitive Natural History—The Darwinian Theory of Instinct—Man and Brute—Mind in Men and Animals—Origin of Human Faculty—Mental Differences between Men and Women—What is the Object of Life?—Recreation—Hypnotism—Hydrophobia and the Muzzling Order; "History of Philosophy," by Prof. Alfred Weber, authorised translation from the fifth French edition, by Dr. Frank Thilly; "Bicycles and Tricycles: an Elementary Treatise on their Design and Construction," by Archibald Sharp, illustrated; "Post-Mortem Examinations in Medico-legal and Ordinary Cases," by J. Jackson Clarke; "Diseases of Plants due to Cryptogamic Parasites," translated from the German of Dr. Carl Freiherr von Tubeuf, of the University of Munich, by Dr. William C. Smith, illustrated; "Magnetic Fields of Force: an Exposition of the Phenomena of Magnetism, Electromagnetism, and Induction, based on the Conception of Lines of Force," by Prof. H. Ebert, translated by Dr. C. V. Burton; "Industries and Wealth of Nations," by Michael G. Mulhall; "Light," by W. T. A. Emtage, with 231 diagrams; "Diphtheria and Antitoxin," by Dr. Nestor Tirard.

The announcements of Messrs. Macmillan and Co., Ltd., include:—*"The Log of a Naturalist in West Africa (Congo Française, Corisco and Cameroons),"* by Miss Mary Kingsley, with illustrations and a map of the Congo Française; *"The Cambridge Natural History,"* vol. ii., with illustrations; *"Flatworms,"* by F. W. Gamble; *"Nemertines,"* by Miss L. Sheldon; *"Thread-worms, &c.,"* by A. E. Shipley; *"Rotifers,"* by Prof. Marcus M. Hartog; *"Polychaet Worms,"* by Dr. W. Bloxland Benham; *"Earthworms and Leeches,"* by F. E. Beddard, F.R.S.; *"Gephyrea, &c.,"* by A. E. Shipley; *"Polyzoa,"* by S. F. Harmer; *"Round the Year: a Series of Short Nature Studies,"* by Prof. L. Miall, F.R.S., illustrated; *"Sketches in Sport and Natural History,"* by the late Dr. George Kingsley, with a memoir by his son; *"The Natural History of the Marketable Marine Fishes of the British Islands,"* prepared expressly for the use of those interested in the sea-fishing industries, by J. T. Cunningham, with a preface by Prof. E. Ray Lankester, F.R.S., illustrated; *"Dictionary of Political Economy,"* edited by R. H. Inglis Palgrave, F.R.S., vol. ii., F.—M.; *"Tree Worship,"* by Mrs. J. Henry Philpot, illustrated; *"The Buddhist Praying Wheel and a Collection of Material bearing upon the Symbolism of the Wheel and Circular Movements in Custom and Religious Ritual,"* by William Simpson, illustrated; *"A System of Gynæcology,"* by many writers, edited by Drs. Thomas Clifford Allbutt, F.R.S., and W. S. Playfair; *"A System of Medicine,"* by many writers, edited by Dr. Thomas Clifford Allbutt, F.R.S., vol. ii., containing "Infections" (continued), "The Intoxications and the Parasites," also the general diseases of obscure causation, such as rheumatism, gout, diabetes, rickets, scurvy, &c.; *"A History of Aryan Medicine,"* by H. H. the Thakore Saheb of Gondal; *"Essays and Addresses by Sir J. Russell Reynolds,"* edited by Samuel Squire Sprigge; *"A Text-Book of Botany,"* by Dr. E. Strasburger, Dr. Fritz Noll, Dr. H. Schenck, Dr. A. F. W. Schimper, translated from the German by Dr. H. C. Porter, revised and edited by A. C. Seward, with 594 illustrations, in part